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MEMORANDUM

SUBJECT: Endangerment Memo: Health Risks Secondary to Exposure to Asbestos at the Former Vermiculite Intermountain Site at 100 South 333 West (SLC2), Salt Lake City, Utah.

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I. PURPOSE

This memorandum presents the rationale for determination of imminent and substantial endangerment to public health from current asbestos contamination associated with the historical processing of vermiculite from Libby, Montana at the Former Vermiculite Intermountain Insulation Facility at 100 South 333 West (SLC2), Salt Lake City, Utah.

II. SUMMARY OF FINDINGS

- 1) Asbestos material is present in dust and soil at the SLC2 site. This asbestos material is consistent with asbestiform amphiboles from Libby, Montana containing a series of closely related minerals including actinolite, tremolite, winchite and richterite. Asbestos fibers of this type are known to be hazardous to humans when inhaled.
- 2) Mechanical disturbance of asbestos-contaminated soil or dust by activities similar to those that are likely to be performed by area workers results in elevated levels of respirable asbestos fibers in air.
- 3) On this basis, it is concluded that: a) soil and dust at this site contain elevated



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levels of friable asbestos minerals from Libby, Montana, b) contaminated soil and dust will result in a complete pathway for human exposure and will serve as a source of on-going release of hazardous fibers to air, and c) it is necessary to reduce or eliminate pathways of exposure of this material to workers and others who may frequent the area.

III. BACKGROUND

A. Libby, Montana Vermiculite Mining

Vermiculite was discovered in the Rainy Creek Mining District of Lincoln County, Montana, in 1916 by E.N. Alley. Alley formed the Zonolite Company and began commercial production of vermiculite in 1921. Another company, the Vermiculite and Asbestos Company (later known as the Universal Insulation Company), operated on the same deposits (BOM, 1953). W.R. Grace purchased the mining operations in 1963 and greatly increased production of vermiculite until 1990 when mining and milling of vermiculite ceased.

Vermiculite ore bodies on Zonolite Mountain contain amphibole asbestos at concentrations ranging up to nearly 100% in selected areas (Grace; per Libby Administrative Record). Although early exploration mining efforts by the Zonolite Company focused upon the commercial viability of fibrous amphibole deposits found on Zonolite and Mountain (DOI, 1928), no commercial production of asbestos from the Libby mine is reported.

Residual fiber contamination at the Libby site and former offsite processing facilities continues to present a potential for hazardous exposure to workers, residents, and visitors at these facilities. Contamination at these sites is presently being addressed under removal authorities provided in the Comprehensive Environmental Response Compensation and Liability Act Section 104 (CERCLA or Superfund). These actions by the U.S. Environmental Protection Agency Region 8 office in Denver, CO, began on November 22, 1999, and continue today.

B. Salt Lake City (SLC2) Vermiculite Processing Site

The Salt Lake City vermiculite business was originally named Vermiculite Intermountain and was started in 1940. The exfoliation plant was originally located in downtown Salt Lake City at 100 South 333 West (SLC2 site). According to a 1984 business newspaper article, Lee Irvine was the president of Vermiculite Intermountain, a company licensed by the W. R. Grace company to manufacture insulation products. The 1984 news article also stated that the manufacturing operations were to be moved to a new Salt Lake City location at 800 South 733 West (SLC1 Site) and continue operations of Intermountain Products. Shortly thereafter operations were moved to the new location and the exfoliation plant continued to operate until closure in 1987. Invoices obtained from W. R. Grace, which purchased the Libby mine in 1963, show that over 25,000 tons of vermiculite ore were shipped to the 100 South 333 West address prior to 1980. EPA has no information at this time concerning the total amounts of Libby vermiculite shipped to Vermiculite Intermountain at this (SLC2) site.

The Site is located in the middle of a downtown city block and is currently surrounded on three

sides by active commercial establishments, Artistic Printing Company, La Quinta, and Utah Paper Box. The 4th side of the site is bordered by the Utah Power and Light (UPL) substation. The Artistic Printing Company, a small custom print shop, is a few feet to the northwest of the Site. The 18,000 sq ft, slab-on-grade building was constructed prior to 1940. The building is currently in daily use by 24 employees working two shifts, 5-days per week. The LaQuinta Parcel, which includes an asphalt AMPCO Parking Lot and the Frank Edwards Building, is situated on the north and northeast sides of the site. The parking lot is used daily by individuals working or visiting downtown establishments or the Delta Center which is located across the street. The Frank Edwards Building is a one-story, 23,000 square foot structure which is located on the northeast corner of the block and is unoccupied. The Utah Paper Box Company is a 57,000 square foot building which was constructed before 1940 and borders the site on the south. The building is currently in daily use by 60 employees working multi-shifts, 7-days per week. On a larger scale, the Utah Power and Light Substation parcel currently encompasses the site. The UPL Substation is located immediately to the west of the Site and consists of an 8,800 square foot, 2-story cinder-block building. The entire UPL parcel surface is capped by crushed gravel to an approximate depth of 0-6 inches. The substation is visited frequently by a limited number of UPL employees and it is reported that a portion of the property is occasionally used for parking by UPL personnel.

C. Asbestos-related Disease:

Asbestos-related diseases include (1) pleural disease (plaques, diffuse thickening, calcifications, and pleural effusions), (2) interstitial disease (fibrosis of pulmonary tissue), (3) lung cancer, and (4) mesothelioma (a rare cancer of mesothelial cells in the pleura or peritoneum) (Albeda, 1982; Anderson, 1976; Kilburn, 1985; McDonald, 1997; MaGee, 1986; Selikoff, 1965). The risk of developing an asbestos-related disease depends on fiber characteristics, the level and duration of exposure, the time since first exposure, the individual's smoking history, and the individual response to the presence of asbestos fibers in pulmonary tissue. Researchers have not determined a safe level of asbestos exposure, but in general the longer a person is exposed to asbestos and the greater the intensity of the exposure, the greater the likelihood for asbestos-related health problems. While some forms of disease, especially cancers, may take as long as forty years to develop, there is concern that even short term exposures may have significant adverse health impacts. This is particularly true for children, where fibers lodged in the lungs may be able to exert their toxic effects for many more years as compared to exposures during adulthood.

IV. ENDANGERMENT RATIONALE

A. Disease from Exposure to Libby Vermiculite Contaminated with Asbestos

Airborne exposure to asbestiform minerals originating from Zonolite Mountain in Libby, Montana is hazardous to human health.

Previous studies in the early 1980's by researchers from McGill University (McDonald 1986a-b) and the National Institute for Occupational Safety and Health (NIOSH) (Amandus 1987a-c) found that former employees of the Libby vermiculite mine had substantial asbestos exposure, as

well as significantly increased pulmonary morbidity and mortality from asbestosis and lung cancer. Researchers at NIOSH who studied the annual chest x-rays of mine and mill workers with at least 5 years tenure (between 1975 and 1982) found an increased prevalence of the radiographic abnormalities associated with asbestos-related disease. A recent followup mortality study of Libby vermiculite workers found that "they have suffered severely from both malignant and non-malignant respiratory disease." The overall proportionate mortality among the group for mesothelioma was extremely high, being similar to that seen for crocidolite miners in South Africa and Australia (McDonald, 2002).

More recent studies conducted in association with the ongoing investigations in Libby have identified markedly elevated mortality rates of asbestosis, lung cancer, and mesothelioma for the Libby population, as well as, significantly increased rates of asbestos-related radiologic abnormalities among non-occupationally exposed individuals who worked or lived in Libby for at least six months prior to 1990 (ATSDR 2000, ATSDR 2002a, ATSDR 2002b, Peipins 2003, EHP 2004).

In addition to the Libby site, contaminated vermiculite ore was shipped and processed at numerous facilities throughout the United States also resulting in elevated asbestos-related disease among workers (Lockey, 1984). In one recently reported case, a man died of progressive asbestos disease 50 years after being exposed to contaminated Libby vermiculite after only 2 months of exposure at an offsite processing plant at age 17 (Wright, 2002). Fatal asbestos disease has also been reported among non-occupationally exposed individuals who directly contacted contaminated vermiculite waste materials around a former processing facility (Srebro, 1994) and contaminated vermiculite attic insulation used in homes throughout the United States (Harashe v. Flintkote, 1993).

B. Asbestos Exposures Resulting From Contaminated Bulk Materials

Disturbance of soils, dusts, insulation, garden products, and other bulk materials contaminated with asbestiform minerals from Libby, Montana results in a complete pathway for airborne human exposure and such exposures may easily approach and exceed available human health guidance.

1. Soils & Dust:

Asbestos fibers in soil or dust are not inherently hazardous to humans if left undisturbed. However, most soils and dusts are subject to disturbance, either now or in the future, by many different types of activities that are common for residents or workers. Ongoing EPA investigations at the Libby site have demonstrated that mechanical disturbance of asbestos-contaminated soil or dust by activities similar to those that are likely to be performed by area residents or workers results in elevated levels of respirable asbestos fibers in air. EPA Region 8 evaluated several scenarios involving disturbance of contaminated soils and dusts such as vehicular traffic on Rainy Creek Road, active cleaning of households, sweeping of dust, and rototilling of soil. These scenarios clearly demonstrated that asbestos fibers may be released into the air by a variety of common activities and that a complete pathway exists by which asbestos-contaminated source materials may cause inhalation exposure of area residents and workers. Additionally, EPA found that the concentrations of fibers in air generated by disturbance of

source materials may exceed OSHA standards for acceptable occupational exposure, as well as, exceeding EPA's typical excess cancer risk range ($1E-04$ to $1E-06$) by an order of magnitude or more. (Weis, 2001a, Weis, 2001b).

In addition to the Libby site, investigations by researchers in EPA Regions 9 and 10 have also found that soils contaminated with very low concentrations of asbestos can easily result in high airborne fiber exposures when disturbed. This is consistent with published research performed by Addison et. al. (Addison, 1988) which showed that even soils containing asbestos concentrations as low as 0.001% can generate potentially hazardous airborne concentrations when disturbed.

Currently EPA has not established an asbestos level in soil or dust below which an exposure does not pose a risk, under any of its regulatory programs. The 1% asbestos concentration levels commonly cited and used for regulatory purposes under the EPA Toxic Substances Control Act (TSCA) abatement program, was established on the basis of analytical capability at the time and does not have any relationship to the actual health risks associated with the handling or disturbance of the contaminated material in question. California EPA is currently in the process of adopting new guidance for asbestos contaminated soils at schools which recommends that soils containing asbestos concentrations greater than or equal to 0.001% asbestos by weight (transmission electron microscopy (TEM) analysis) may need to be remediated, especially in high use areas such as playing fields and dirt roads (Cal/EPA, 2004).

Of note, findings of "trace" asbestos concentrations by the commonly used polarized light microscopy (PLM) methods for bulk material analysis, typically soil, indicates that the asbestos concentration of the bulk material is at the very least about 0.2% (the analytical limits of the method); which is well above soil concentrations of 0.001 % identified (TEM methods) as being potentially hazardous. Additionally, "non-detectable" concentrations of asbestos in solid media as reported by PLM may still contain hazardous concentrations of asbestos which will become airborne if disturbed. Such was the case observed by EPA investigators (Versar, 2002) in which vermiculite insulation found to be non-detectable for asbestos by PLM techniques, released hazardous concentrations of airborne asbestos fibers, exceeding the OSHA PEL, when disturbed. Depending on the circumstances, higher resolution techniques, such as TEM, may be more useful to ensure accurate identification of low, yet still potentially hazardous, concentrations of asbestos in solid matrices.

2. Libby Vermiculite Products

Disturbance of vermiculite products (e.g., vermiculite insulation, vermiculite garden products) originating from the Libby mine can result in elevated levels of respirable asbestos fibers in the air. Activities similar to those likely to be performed by homeowners and workers that disturb vermiculite products containing even trace amounts or non-detectable concentrations of asbestos by PLM methods, have been demonstrated to release concentrations of fibers which may well exceed OSHA and EPA guidelines (Versar, 2002; EPA Region 10, 2000). Recognition of this finding has resulted in national warnings by EPA, ATSDR, and NIOSH concerning the dangerous nature of vermiculite insulation used in residences and businesses throughout the United States (EPA & ATSDR, 2003; NIOSH Fact Sheet 2003)

C. Occupational Exposure Guidance & Acceptable Risks

While airborne asbestos exposures resulting from disturbance of contaminated bulk materials may approach and exceed occupational limits, the use of occupational methods and guidance for uninformed workers and residential populations is problematic and is not adequately protective of human health.

Comparisons of non-occupational airborne asbestos measurements to the OSHA PEL are somewhat problematic in that the OSHA method (typically NIOSH 7400) specifies the use of a phase contrast microscope (PCM). The Agency's experience with analyzing materials for Libby amphibole asbestos is that the PCM will undercount asbestos fibers thinner than 0.25 μm , while counting non-asbestos materials with a fibrous appearance such as grass or leaf fibers (Libby Action Memorandum, May 2002; Weis, December 2001). The end result is that a TEM analysis of an outdoor or even an interior residential sample would report a lower value than a PCM analysis if potentially interfering materials (e.g., leaves, carpet fibers, sawdust) are present.

Additionally, it should be noted that OSHA limits for asbestos exposure are established for presumably healthy, informed workers who: a) are trained about the hazards of the occupational environment, b) have specific asbestos training and access to appropriate personal protective equipment, and c) actively participate in an appropriate medical surveillance program. The occupational guidelines are not intended to be protective of the myriad members of an unsuspecting population, including children or those with sensitized or compromised pulmonary conditions. OSHA when it established its "permissible exposure limit" (PEL) of 0.1 fiber/cc for workers stated that its "risk assessment . . . showed that reducing exposure to 0.1 f/cc would further reduce, but not eliminate, significant risk. The excess cancer risk at that level would be reduced to a lifetime risk of 3.4 per 1,000 workers and a 20 year exposure risk of 2.3 per 1,000 workers" (59 FR 40964, 40978). OSHA also noted that the agency "has always considered that a working lifetime risk of over 1 per 1000 from occupational causes is significant" (59 FR at 40966). Notably, OSHA found that the 0.1 f/cc exposure level would present an even greater risk except for the fact that "the exposure limit is accompanied by mandated work practice controls and requirements for hazard communication, training and other provisions" (59 FR at 40981). In other words, the 0.1 f/cc exposure level is appropriate only for those trained workers who receive protective gear and work under mandated conditions, and even then, the significant risk is not eliminated (Preamble to OSHA's rules setting occupational asbestos limits published in the Federal Register on August 10, 1994).

V. SLC2 SITE ENVIRONMENTAL DATA EVALUATION

A. Exterior Areas

In October 2002, EPA investigators performed exterior inspection and soil sampling in a rectangular area around the former vermiculite processing facility (of note: the facility is no longer present). During this evaluation, the area was divided into 37 grids with about three samples collected per grid at soil surface and subsurface locations. Of the 100 samples collected, vermiculite was visibly present about 30% of the time. Sampling analysis by PLM found the

presence of Libby Amphibole (LA) in 92% (92/100) of all samples, with LA concentrations ranging from non-detectable to 18%. Fifteen percent of the samples revealed LA concentrations equal to or in excess of 1%.

In September 2003, EPA investigators performed additional site sampling and characterization. During this investigation soil sampling was extended to perimeter areas of the overall site, as well as, areas outside of other facilities located on the site that were not assessed previously. The presence of LA was found in 58% of the 72 soil samples evaluated by PLM. Samples with non-detectable concentrations of LA were most commonly found in area grids located along the outside perimeter of the site.

B. Interior Areas

1. Dust Sampling results:

During the September 2003 site visit, EPA investigators collected five interior dust samples within Artistic Printing and three dust samples within the Utah Power and Light Blockhouse. In December 2003, EPA investigators performed additional interior dust sampling of several facilities, including Artistic Printing (6 samples), La Quinta (3 samples), and Utah Paper Box (6 samples). The following summarizes the results of these dust samples:

- * Artistic Printing. Dust sample results for Artistic Printing showed the presence of LA fibers in 73% (8/11) of the samples, with LA concentrations in positive samples ranging from 122 to 14,600 S/cm².
- * Utah Power & Light. Dust sample results taken in the Blockhouse revealed the presence of LA fibers in all three samples, with LA concentrations ranging from 2,400 to 292,000 S/cm².
- * La Quinta. Two of the three dust sample taken in differing areas of the La Quita facility revealed the presence of LA fibers, with LA concentrations ranging from 353 to 1,160 S/cm².
- * Utah Paperbox. The six dust samples taken in Utah Paperbox did not reveal the presence of any LA fibers. Chrysotile asbestos, not related to Libby vermiculite processing, was detected in one dust sample. This facility was reported to have a very rigorous housekeeping program which entailed thorough and regular cleaning of the work areas, especially during installation of new high-end equipment.

2. Air Sampling results:

In December 2003, in addition to dust samples, EPA investigators collected several air samples within Artistic Printing and Utah Paperbox facilities. At Artistic Printing, the results of the two personal and five stationary air samples revealed the presence of airborne LA fibers (0.003 S/cm²) in one stationary air sample collected in the Administrative Office area. At Utah Paperbox, the results of the one personal and six stationary air samples did not reveal the presence of airborne LA fibers in any of the samples.

VI. SUMMARY

- A. Visible vermiculite was widely seen in surface and subsurface soil evaluations throughout the SLC2 site. Furthermore, detectable concentrations of LA, in one instance as high as 18%, was found in over 92% of the surface and subsurface soil samples taken in close proximity to the area of the former vermiculite facility and 52% of the soil samples taken at more distant locations around other facilities and the perimeter of the site. LA contaminated surface soils contain asbestos fibers which are likely to become airborne when disturbed by foot traffic, automobile traffic, and a variety of other routine activities.
- B. Interior dust samples taken inside Artistic Printing, La Quinta, and the Utah Power & Light Blockhouse showed detectable concentrations of LA fibers. Results of limited air sampling in the Artistic Printing facility during routine work conditions found the presence of airborne LA fibers in an administrative office area.
- C. The presence of LA contaminated exterior soils and interior dusts poses an exposure hazard for individuals, such as workers, who may frequent and disturb such materials on a routine basis. Asbestos contaminated source materials, such as surface soils, may also serve as an ongoing reservoir for fiber emission and contamination into co-located indoor environments or vehicles, through air currents or transport via human activity (i.e., soil adherence to shoes). Once contaminated, such areas or vehicles can then in-turn serve as secondary sources of ongoing human exposure.
- D. Findings of airborne LA fibers in an office area of Artistic Printing demonstrates the propensity of contaminated environments to release fibers into the air and form a completed pathway for human exposure. Outdoor activities (e.g., raking and leaf blowing) performed at the newer Vermiculite Intermountain site located at 800 South 733 West (SLC1 Site) demonstrated that even soils containing less than 1% LA can generate airborne exposures which easily approach, and even exceed, the occupational limits when disturbed. These findings are consistent with the results of EPA investigations at other sites, as well as, evaluations performed by other government agencies and researchers. For example, disturbance of an outdoor high school playing field containing 0.01% asbestos concentrations resulted in hazardous airborne asbestos concentrations when disturbed (communication per A. Den, EPA Region 9).
- E. Chronic, and even higher dose short-term, exposures to airborne LA fibers pose an increased risk for lung diseases such as pleural fibrosis, asbestosis, mesothelioma, and lung cancer. Sampling events at the Intermountain Insulation Site have confirmed the presence of amphibole asbestos in soils, dust, and visible vermiculite at concentrations of concern and indicate an on-going risk to workers and visitors who may routinely frequent the site. Given the known toxicity of LA for causing asbestos-related disease and mortality, it is reasonable to conclude that any human exposure, especially those more frequent and of higher concentration, to the LA asbestos may pose an imminent and

substantial threat to public health and welfare

VII. CONCLUSION

Libby amphibole asbestos contamination exists in outdoor soil throughout the SLC2 site, as well as, indoor dust in the Artistic Printing, La Quinta, and Utah Power & Light facilities. If these contaminated sources are disturbed by human activities, fibers are likely to be released to air. The levels of fibers released to the air depends upon the concentration of fibers in the source material(s) and on the nature of the disturbance(s). The risks of human disease are proportional to the concentration of fibers in air and the frequency and duration of exposures. While data are not yet sufficient to perform reliable human-health risk evaluations for all sources and all types of disturbances; it is apparent that airborne fiber concentrations demonstrated to occur with disturbance of contaminated soil and dust, similar to that observed at the SLC2 site, can exceed acceptable health risks for both residents and workers. This is especially true for naive work populations that are not aware of ongoing exposures, nor trained to handle asbestos, nor enrolled in appropriate worker protection and medical surveillance programs. On this basis, I recommend that steps be taken to reduce or eliminate pathways of human exposure to LA from contaminated source materials, such as soil and dust, at the Vermiculite Intermountain Site at 100 South 333 West (SLC2), Salt Lake City, Utah, in order to protect naive work populations or other individuals who may regularly utilize this site.

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